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INCREASING THE QUALITY OF DIAMOND WHEELS FOR MANUAL GRINDING OF COMMERCIAL AND ART GLASS

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It was shown that use of AS32 – AS50 diamond powders (instead of AS6 – AS15 powders) combined with a new metal bond with hardness of *HB* 75 – 85 (in comparison to M2-01 binder) allows prolonging the lifetime of wheels by 1.5 – 2 times in grinding articles made of commercial and art glass, reducing the specific diamond consumption, and increasing the cutability of the instrument.

Processing of high-quality and art glass is the traditional area of application of diamond grinding wheels both in the Russian Federation and abroad. In the Russian Federation, 2.5 – 3 million carats of synthetic diamond powders and 0.75 – 1 million carats in the Czech Republic are used for this operation annually. To reduce the cost of manufacturing articles made of high-quality and art glass, studies were conducted on increasing the quality of metal-bond diamond wheels for manual grinding due to the use of stronger diamond powders and the development of a new metal bond.

Since grinding wheels lose cutability during grinding, the optimum strength of the diamond powder used was determined. The working capacity of the wheels in the most widely used M2-01 metal bond with hardness of *HB* 85 – 95 was investigated until the cutability was lost in processing glass, which took place in wear of the diamond grains to the level of the bond. The studies were conducted with the method regulated by GOST 1681–82 [1]. Type 1A1 wheels with diamond powders with 106/90 μm granularity and 100% concentration at a grinding rate of 25 m/sec, feed of 1500 mm/min, and grinding depth of 1 mm. Glass bars containing 24% PbO measuring 150 × 100 × 20 mm were ground. Water was used as the coolant. The specific diamond consumption was determined by weighing on a VLT-1-1 balance. Each experiment was repeated a minimum of five times to determine the average value of the specific diamond consumption and cutability of the wheel.

The data obtained show (Fig. 1) that when the strength of the diamond powder grains increased, the mass of the glass removed before the wheel lost cutability increased. For AS4, AS6, AS15, AS32, and AS50 diamond powders, cutability was lost after removal of 1050, 1200, 1400, 2000, and 2600 g of glass, respectively. These results are principally in agreement with the previously obtained results for a smaller range of changes in the strength of the diamond powders [2, 3].

For the stronger diamond powders AS32 – AS50, a new bond with hardness of *HB* 75 – 85 was developed by changing the copper and tin ratio and was used instead of the traditionally used M2-01 bond with hardness of *HB* 85 – 95.

The studies were conducted with the method regulated by GOST 30352–96 on a special bench based on a universal grinder [4]. The sample was held to the grinding wheel by the weight of a counterweight that acted through blocks placed on the base of the grinder and controlled by a dynamometer with a 0.1 mm scale factor. Grinding was conducted with type 1E1 wheels. The wheel speed was 26 m/sec. Blass bars containing 24% PbO and measuring 150 × 100 × 20 mm were ground. Water was used as the coolant. The tests were performed for wheels with diamond powders with

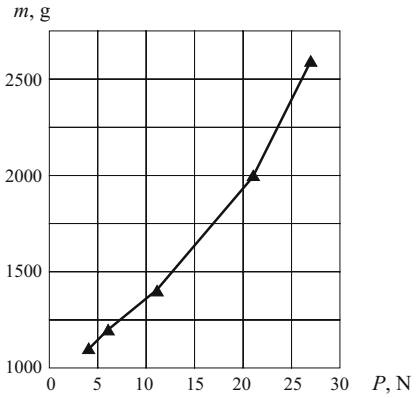

Fig. 1. Mass *m* of glass removed before loss of cutability as a function of diamond grain strength *P*.

[1] VeAl Co., Venev, Russia.

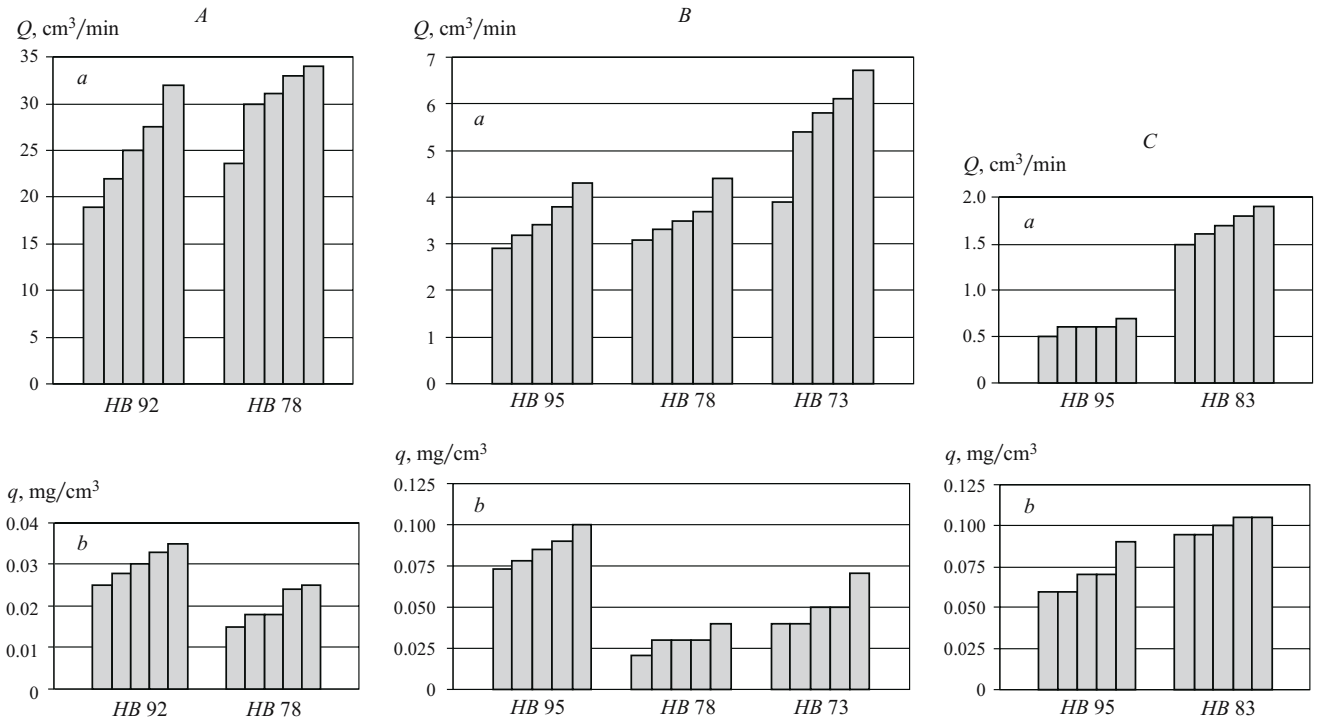

Fig. 2. Cutability of the wheel Q (*a*) and specific diamond consumption q (*b*) for wheels of different hardness with powders with 250/212 μm (*A*), 53/45 μm (*B*), and 30/40 μm granularity (*C*).

granularity of 250/212 and 53/45 μm and with diamond micropowder with granularity of 30/40 μm, i.e., with the granularities most frequently used for processing articles made of high-quality and art glass. The new bond with hardness of *HB* 75 – 85 was compared with the M2-01 bond with hardness of *HB* 85 – 95 with the same wheel granularity.

The tests showed that using the new bond instead of the M2-01 bond for diamond wheels with 250/212 μm granularity and AS50 strength reduced the specific consumption of diamonds by 1.3 – 1.4 times and increased the cutability by 1.2 – 1.3 times (Fig. 2*A*), while the specific consumption of diamonds decreased by 1.6 – 1.7 times with the same cutability for wheels with powder with 53/45 μm granularity and AS32 strength. A further decrease in the bond hardness due to a change in the ratio of copper and tin made it possible to reduce specific diamond consumption by 1.35 – 1.45 times and increase the cutability by 1.55 – 1.65 times (see Fig. 2*B*). For wheels with 30/40 μm diamond powder, use of the new bond instead of M2-01 bond increased the cutability by 2.8 – 2.9 times while increasing specific diamond consumption by 1.35 – 1.45 times (Fig. 2*C*).

As a result of these studies, the new bond was recommended for industrial production of wheels for grinding high-quality and art glass. The wheels on the new bond are currently being successfully used at more than 150 enterprises in the Czech Republic.

Use of AS32 – AS50 diamond powders instead of AS6 – AS15 powders makes it possible to prolong the lifetime of the wheels by 1.5 – 2 times in grinding articles made of high-quality and art glass.

Use of the new metal bond with *HB* 75 – 85 hardness instead of the M2-01 bond improves the quality of diamond wheels:

by reducing specific diamond consumption by 1.3 – 1.4 times for the same increase in cutability (using grinding powders with 250/212 μm granularity);

reducing specific diamond consumption by 1.5 – 1.7 times while retaining the same cutability (powders with 53/45 μm granularity);

increasing cutability by 2.8 – 2.9 times with a two times smaller increase in specific diamond powder consumption (powders with 30/40 μm granularity).

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